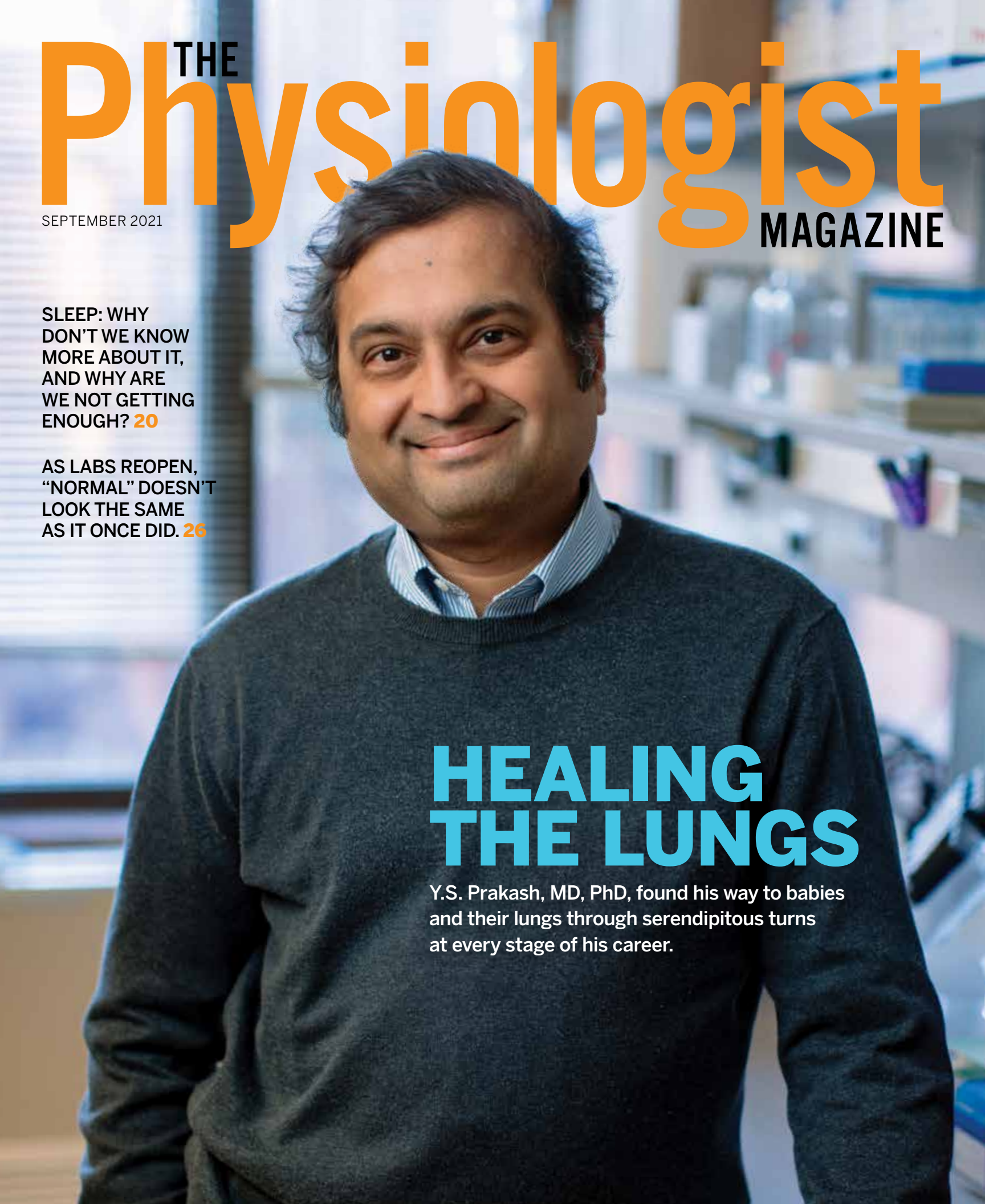
THE Physiologist MAGAZINE
SEPTEMBER 2021



SLEEP: WHY DON'T WE KNOW MORE ABOUT IT, AND WHY ARE WE NOT GETTING ENOUGH? 20

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HEALING THE LUNGS

Y.S. Prakash, MD, PhD, found his way to babies and their lungs through serendipitous turns at every stage of his career.

APPLY FOR SOCIETY AWARDS

american physiological society®

The American Physiological Society (APS) provides more than $1 million in awards and fellowships each year as part of our mission to encourage excellence in physiological research and education. These awards are a vital investment in our researchers and educators of all career levels.

Learn more about all the available opportunities and apply for the awards highlighted below at **physiology.org/awards**.

September **15**

A. Clifford Barger Underrepresented Minority Mentorship Award

$1,000 honorarium. Honors a member who has demonstrated leadership, guidance and and mentorship of students from underrepresented backgrounds.

September **15**

Bodil M. Schmidt-Nielsen Distinguished Mentor and Scientist Award

$1,000 honorarium. Honors a member with outstanding contributions to physiology research and dedication to training young physiologists.

October **1**

Henry Pickering Bowditch Award Lectureship

$2,500 honorarium. Honors an early-career member for original and outstanding accomplishments in the field of physiology. Awardee selected by the APS president.

October **1**

Physiology in Perspective: The Walter B. Cannon Award Lecture

$4,000 honorarium. Honors a member with original and outstanding accomplishments in the field of physiology. Awardee selected by the APS president-elect.

November **14**

Annual Marion J. Siegman Lectureship Award

$1,000 honorarium. Honors an established researcher who has made outstanding contributions toward opening new avenues of investigation in the field of physiology.

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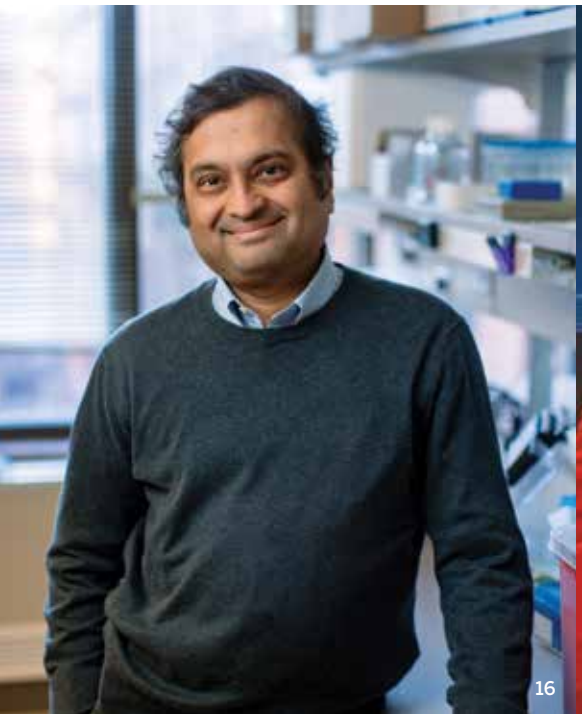

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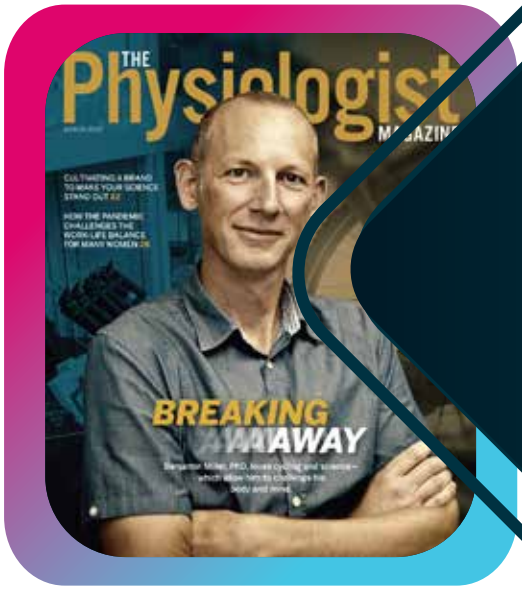

Share your thoughts by December 31.

SCAN ME

First Annual Readers Survey

We relaunched *The Physiologist Magazine* in 2019 to put the spotlight on **YOU**: the smart, innovative, curious and creative people who are on the frontiers of scientific discovery and our understanding of life and health.

We Want to Hear from YOU

- What do you think of the magazine?
- How can we improve?
- What do you want to learn more about?

Share your thoughts at **physiology.org/TPMSurvey**.

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Changing the Way We Work

BY SCOTT STEEN, CAE, FASAE

Recently, I asked several APS member leaders how the pandemic has called into question traditional ways of working at their universities and labs and how they think things might be different going forward as a result.

Not surprisingly, many see the pandemic mainly in terms of loss and added hardship. Students, postdoctoral fellows and junior faculty have been particularly negatively affected, losing valuable lab time, access to principal investigators and mentoring from senior colleagues. Both workload and administrative burden have increased. Others mentioned the importance of impromptu conversations in science, with one noting that the spontaneous social interactions that make science fun, productive and inspiring have been made more difficult. Disruption in the supply chain has affected the availability of some lab supplies and made running a lab more expensive.

Our member leaders also saw several positive trends emerge from these calamitous times, along with a number of lessons that will likely inform the future. This is particularly true in teaching. As one leader said, "I think the pandemic forcing people to teach virtually has done more to accelerate the use of interactive teaching and learning than all formal pre-pandemic efforts so far." Overall, greater work flexibility and more frequent at-home work has reduced stressful commutes and, for many, increased productivity.

"These trying times have transformed the way we work and made us rethink many areas of our operation."

At APS headquarters, these trying times have transformed the way we work and made us rethink many areas of our operation. As a result, we anticipate that both the way we do our work and the way we engage our members will be significantly different moving forward.

Certainly, we have experienced our share of difficulties as APS staff have worked at home for the past 18 months. Sharing a workspace with your spouse and children, or working in tight quarters, can be tough. We've experienced Zoom fatigue and loneliness. We've also found we need to be a lot more deliberate about building culture, sharing information and collaborating outside our areas of responsibility.

That said, I have also been blown away by the resiliency, creativity, productivity and agility of our team. During the pandemic, we have launched major new products, found new ways to engage members, shifted on a dime to adapt to changing realities and continued the high standard of member service that APS is known for. Staff members have also enjoyed a greater quality of life, avoiding the horrible commutes that are part of life in the greater Washington, D.C., area.

Going forward, APS team members will have significantly greater flexibility regarding where and when they work. We expect roughly 80% of our team will work in the office one day or less per week. As a result, we will be augmenting our technology to better facilitate remote work and collaboration. We will also be reducing our office footprint and redesigning our remaining office space to focus on the new ways people will be using the space.

Our member engagement strategy will change, too, with fewer face-to-face committee meetings and more short virtual meetings that allow for greater participation, regardless of location. We are also developing more opportunities for shorter volunteer assignments through advisory panels, project task forces and one-time member focus groups. We will continue to significantly grow our webinar and online learning programs and resource libraries. And we will be making greater use of virtual components in our face-to-face meetings.

Without a doubt, the pandemic has been an enormously sad, difficult and challenging time for people around the globe. But it also presents us with an opportunity to learn new lessons born from necessity. At APS, we are using the lessons of the pandemic to create a better workplace for our staff and a more engaging and accessible Society for our members.

Scott Steen, CAE, FASAE, is executive director of the American Physiological Society.

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Alliance for Aging Research

2021 Science of Aging: A Physiological and Translational Perspective

Dive into the latest research and discoveries relating to the physiological mechanisms of the aging process and aging-related disease. Join us for the latest American Physiological Society webinar series and attend sessions on the following topics:

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- Aging and bone health—on-demand
- Neurodegeneration and Alzheimer's disease—on-demand
- Muscle atrophy and aging—September 29
- Cardiac inflammation and repair following myocardial infarction—October 13

Register today at:
physiology.org/webinars/aging

The Physiologist MAGAZINE

VOL. 64 | SEPTEMBER 2021

The Physiologist Magazine is published bimonthly and distributed by the American Physiological Society (APS).
6120 Executive Boulevard, Suite 600, Rockville, MD 20852-4911

SUBSCRIPTIONS
The Physiologist Magazine (ISSN 0031-9376) is distributed to members as part of their membership. Nonmembers in the U.S. (print only): Individuals $260. Nonmembers international: Individuals $315. Tier definitions/custom pricing: www.physiology.org/tiers. The American Physiological Society assumes no responsibility for the statements and opinions advanced by contributors to *The Physiologist Magazine*. Please notify the APS Membership Department of changes to your address or telephone number.
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New Trends in Sex and Gender Medicine

Virtual

October 19–22, 2021

Diversity Conference Scholarship Deadline: October 1

physiology.org/SexGenderConf21

american physiological society®

Celebrating its 20th anniversary, the focus of this conference is on new areas of research associated with sex and gender differences, including sex-specific risk factors, transgender health issues and developmental programming of adult disease.

Join us as we translate work by junior investigators and trainees pursuing basic and clinical research and relate these findings to major clinical issues in cardiovascular, renal, endocrine and immune system diseases.

At work and at play, physiologists and other scientists made the most of the last days of summer. Take a look at what people were up to.

Share your story with us and it may appear in the next issue of *The Physiologist Magazine*. Email your thoughts—and links to your tweets and posts—to tphysmag@physiology.org.

Hailey A Parry, PhD
@parry_hailey

I took a vacation after finishing my PhD. The time to rest was much needed, but I wanted to share the cool adventure I went on. Here is the hike to the top of Pikes Peak!

1:21 PM · Jun 24, 2021

Dr. Bates
@BatesPhysio

Rings and Seven are hopeful you'll be as happy tonight as they are enjoying green peppers!!! Comparative #physiology!!!

5:58 PM · Jul 13, 2021

Katsu Funai
@KatsuFunai

building a cell

7:38 PM · Jul 7, 2021

Dr. Diana Martinez
@5FootScientist

Requested a quote for a scientific product and made it clear that I'm the PI. Got the quote with Ms. Diana Martinez in bold on the top. Sent back this email. There are < 1% latina/latinx in the professoriate. Use my title. #AcademicChatter #WomenInSTEM #Latinx #WomenInScience

Re: [EXTERNAL] New Lab Quote

Hi Peter,

Could you please correct the quote? I'm the PI of the lab and it's Dr. Diana Martinez.

Best,
Diana

8:57 PM · Jun 30, 2021

The Call Lab
@Call_LabUGA

Congratulations 🎉 to the 2020 & 2021 Mitochondrial Physiology champs! A little late getting the nameplates engraved for the 2020 winners, but great job Ryan Gebhardt, Jordan Schaeffer, Rameen Forghani (@RameenForghani), Jun-Won Heo (@Heojw1117), Ryan Millikan, and Katherine Keung.

12:25 PM · Jul 19, 2021

Carmen De Miguel, PhD, MS, FAHA
@Carmendemigue12

De Miguel lab—summer 2021 edition! I love the energy and enthusiasm that summer undergrad students bring to my lab. Look at those smiley faces! @UAB_NRTC @KidneyTrain_UAB @KidneyInCVD

7:36 AM · Jul 7, 2021

Naomi Charalambakis, PhD
@NCharalambakis

Yes! 👏🏻 and they are NOT "alternative" careers, they're just... careers 😉 #AcademicTwitter #phdvoice #phdlife

Fay Lin, PhD @xiaofei_lin · Jun 23
Message to any PhD students who have doubts:

There are COUNTLESS professional opportunities in science outside of #academia.

#AcademicTwitter #phdchat
Show this thread

10:15 PM · Jun 23, 2021

Follow APS on Twitter @APSPhysiology @SciPolAPS @APSPublications

LAB NOTES

STATS & FACTS

1 in 25

The portion of adult drivers who reported nodding off behind the wheel in the previous 30 days.

U.S. Centers for Disease Control and Prevention

RESEARCH FIZZ

Pleth variability index may predict preload responsiveness in patients treated with nasal high flow: a physiological study

This study suggests that the pleth variability index may be useful in making daily treatment decisions for critically ill respiratory failure patients.

***Journal of Applied Physiology*, June 2021**

https://doi.org/10.1152/japplphysiol.00614.2020

MENTORING Q&A | SET UP FOR SUCCESS

It's a Postdoc Life

How to prepare for postdoctoral training.

Each issue, we ask a trainee member to pose their career questions to an established investigator and mentor. Here, Lindsey Ramírez, a graduate research assistant at the Medical College of Georgia and an APS 2020–2021 Porter Fellow, asks Kathryn Sandberg, PhD, professor and vice chair for research in the Department of Medicine at Georgetown University in Washington, D.C., questions about how to create a successful postdoctoral experience.

Q: What are some things that you needed in your postdoctoral laboratory to be successful?

A: It goes without saying that resources (supplies and equipment) necessary to conduct state-of-the-art research is imperative. Additionally important is the critical mass of brilliant colleagues who are similarly

Illustrations by Kagan McLeod; far left: iStockphoto

passionate about biomedical research. I learned so much from my peers during my postdoctoral experience at the National Institutes of Health (NIH). Furthermore, many of these colleagues remain my closest of friends.

Q: At what point in your postdoctoral training should you have the conversation with your principal investigator (PI) about what data is the PI's and what data is available for the postdoc?

A: History repeats itself. I highly recommend talking to postdoctoral fellows who have left the laboratory. How many were able to navigate these waters? It can be a non-issue for some PIs, while for others, it is clear that unless the postdoctoral fellow moves tangentially, there will be a bitter divorce when discussing whose data is whose data. Be prepared.

Q: How do you know when to continue with a project or hypothesis versus when to move on to something else?

A: You don't know. Therefore, I highly recommend balancing a high-risk project with a bread-and-butter project that is sure to lead to publications. The ratio of time spent on the high-risk to bread-and-butter projects depends upon your publication record. If it is strong, you can afford more time on the high-risk research, whereas if it is weak, then you know what to do.

Q: How do you find that middle ground and get what you need for your career and research without being seen as the pushover on one end or aggressive on the other end?

A: Becoming known in your field will promote, facilitate and advance your research career by making you more competitive for the funds you need to conduct your research. It is hard to be known if you are a wallflower. I think aggressive is a good quality as long as you are fair-minded. While stealing someone's credit is not a good reputation to engender, graceful self-promotion is a valuable skill to develop.

Q: How do you prepare for interviews?

A: I learned the most about preparing for interviews from Dr. Caleb McKinney, assistant dean of graduate and postdoctoral training and development at Georgetown University. He runs a workshop on this topic for graduate students and postdoctoral fellows. One of Dr. McKinney's key points is the importance of knowing the needs of the one offering the job. It is critical to do one's homework and understand your audience. Furthermore, the best way to prepare for interviews is to practice interviewing. Ask your mentors to conduct mock interviews with you.

Q: How do you develop the skills to be a good mentor?

A: I learned something valuable about mentorship from every PI with whom I trained. When it came to modeling great mentorship, however, Dr. Ron L. Schnaar was the most influential. Accordingly, I thought I knew everything necessary to become a good mentor. When I became director of a NIH-funded training program in 2015, I was required to take mentorship training. That workshop series made me realize being a good mentor is an ongoing educational experience, in part because one is constantly learning from one's mentees.

Got a career question you'd like to submit? Email it to tphysmag@physiology.org. We may use it in an upcoming Mentoring Q&A.

> **"Becoming known in your field will promote, facilitate and advance your research career by making you more competitive for the funds you need to conduct your research."**

STATS & FACTS

35.2%

The portion of adults in the United States who get less than seven hours of sleep a night.

U.S. Centers for Disease Control and Prevention

RESEARCH FIZZ

Heat therapy: mechanistic underpinnings and applications to cardiovascular health

This review explores current literature on the cardiovascular benefits associated with heat therapy.

***Journal of Applied Physiology*, June 2021**

https://doi.org/10.1152/japplphysiol.00141.2020

STATS & FACTS

7

Those causes of death among the top 15 in the U.S. associated with reduced sleep duration.

***Healthcare* journal**

Right: iStockphoto

RESEARCH FIZZ

Short term intensified training temporarily impairs mitochondrial respiratory capacity in elite endurance athletes

Elite athletes were found to have temporary mitochondrial impairment after intense workouts, suggesting they may need to be mindful about overtraining.

Journal of Applied Physiology, June 2021

https://doi.org/10.1152/japplphysiol.00829.2020

RESEARCH FIZZ

Effects of Totum-63 on glucose homeostasis and postprandial glycemia: a translational study

Totum-63, a plant-based compound developed to reduce the risk of type 2 diabetes, improved glucose and insulin levels after a high-carbohydrate meal.

American Journal of Physiology-Endocrinology and Metabolism, June 2021

https://doi.org/10.1152/ajpendo.00629.2020

POLICY IQ | SCIENCE ADVOCACY

Fighting Funding Cuts Started My Science Advocacy Journey

BY KATHERINE A. WILKINSON, PHD

Until shortly after I started my faculty position, I did not really know how to effectively advocate for science or other issues I cared about. I knew voting and having conversations with people I knew were important, but what else could I do?

Now, I feel comfortable talking with elected representatives, submitting op-eds and working with the members and staff of the APS Science Policy Committee to develop advocacy strategies to advance the goals of Society members. While this level of involvement is not right for everyone, I would encourage all APS members to consider joining me in advocating for the causes you are most passionate about.

Right before the start of my second year at California's San José State University (SJSU) in 2013, the federal sequester led to a more than 50% cut to one of the SJSU training programs supported by the National Institutes of Health called the Maximizing Access to Research Careers (MARC) program. At the time, Joy Franco in my research lab was supported by the MARC program, which provided her tuition, a stipend and a community of scholars who, like her, came from traditionally underserved communities. We worked together with other MARC students and faculty to write a script to use when calling our legislators and invited then-Rep. Mike Honda (D-CA) to campus to meet with students and tour a few research labs.

We ultimately weren't successful in reversing the MARC funding cuts, but the experience encouraged me to seek out opportunities to learn how to become a more effective advocate. Participating in the Society for Neuroscience's Early Career Policy Advocacy Fellowship, joining the APS Science Policy Committee and completing SJSU's OpEd Project's Public Voices Fellowship gave me tools to better understand the appropriations and legislative process and better communicate with the public and my elected officials.

Above right and left: iStockphoto

"Elected officials and their staff want to hear how policies and funding affect you—their constituent. One of the more uncomfortable things I learned from my journalist mentors during the Public Voices training was to lean into my expertise and explain why people should listen to me."

SHARING STORIES

As scientists we are often encouraged to write in the passive tense and feel most comfortable explaining our data to others in our direct field. However, effective advocacy relies more on sharing personal stories than lots of facts and figures. Elected officials and their staff want to hear how policies and funding affect you—their constituent. One of the more uncomfortable things I learned from my journalist mentors during the Public Voices training was to lean into my expertise and explain why people should listen to me.

The advocacy skills I've learned in my professional life have also helped me contribute to other causes I care about. For two years I was the volunteer legislative lead for the San José Moms Demand Action for Gun Sense in America group. In that role, I organized our talking points, scheduled meetings and helped train volunteers to feel comfortable sharing their stories and our group's legislative goals. I developed a good relationship with my local congressional office since they have met with me many times. I was honored to be Rep. Zoe Lofgren's choice to represent CA-19 in the Electoral College last December, a truly unique experience.

Wilkinson, on the left, with California Rep. Zoe Lofgren, who selected Wilkinson to represent CA-19 in the Electoral College in 2020.

Below courtesy of Katherine A. Wilkinson, PhD; far right: *Physiological Reviews*

GETTING STARTED

Moving outside your comfort zone to advocate to your elected officials or the public can be nerve-wracking at first, but it gets much easier with practice. Most universities have media relations training, and there are a lot of resources on the APS website on how to get started advocating for science.

I would also encourage early-career members to consider applying to the APS Early Career Advocacy program (**www.physiology.org/AdvocacyFellowship**) in December and encourage all members to consider applying for the APS Science Policy Committee (**www.physiology.org/SciencePolicyComm**).

While the amount of time I can devote to advocacy varies depending on the year, I've found it to be a satisfying experience overall. I hope that many of you will join me in working toward APS' advocacy goals.

Katherine A. Wilkinson, PhD, is associate professor of biological sciences at San José State University in California and chair of the APS Science Policy Committee. She is also a Public Voices Fellow with the OpEd Project.

STATS & FACTS

660,000

Jobs lost in the higher education labor force during the COVID-19 pandemic.

The Chronicle of Higher Education

RESEARCH FIZZ

Do hippocampal pyramidal cells respond to nonspatial stimuli?

The response of rodents' hippocampal cells to nonspatial stimuli almost always depends on the animal's location. This review provides strong support for the "cognitive map" theory.

***Physiological Reviews*, July 2021**

https://doi.org/10.1152/physrev.00014.2020

STATS & FACTS

90,000

Jobs gained in the higher education labor force in May 2021.

The Chronicle of Higher Education

RESEARCH FIZZ

Dietary fat and low fiber in purified diets differently impact the gut-liver axis to promote obesity-linked metabolic impairments

Diets containing low fiber and high fat cause significant shifts in the composition of the gut microbiome.

American Journal of Physiology-Gastrointestinal and Liver Physiology, June 2021

https://doi.org/10.1152/ajpgi.00028.2021

STATS & FACTS

50–70 million

The number of adults in the U.S. with sleep disorders.

American Sleep Association

RESEARCH FIZZ

Music-selective neural populations arise without musical training

People without musical training have areas of the brain that can identify and respond to music, even if they are unfamiliar with the genre.

Journal of Neurophysiology (JNP), June 2021

https://doi.org/10.1152/jn.00588.2020

Yates leads a youth injury prevention class at the New York Giants' practice facility in New Jersey.

UNDER THE MICROSCOPE

Rapid Fire Q&A

Brandon A. Yates, MS, CSCS, PhD student, talks about being a strength and conditioning coach and shares the scientists he would have liked to have worked with.

Q: What do people call you?
A: As a former strength and conditioning coach and basketball student manager, most people tend to call me Coach B.

Q: What inspired you to become a scientist?
A: The realization that research was vital to the development and implementation of exercise prescriptions, and I wanted to know more about how muscles grow.

Q: How has the pandemic changed the way you work?
A: I'm my adviser's first doctoral student, so I had the privilege of being able to pop in his office whenever I had questions or study ideas. However, the pandemic changed that, and now we have to have frequent Zoom meetings, which just are not the same as face-to-face.

Q: "Old school" technique you're most proud of mastering?
A: VO2 max testing.

Q: If you could meet any scientist (living or dead) who would it be and why?
A: The father of progressive resistance training, Thomas L. DeLorme, MD. His work is why I'm both an avid weightlifter and a physical medicine- and rehabilitation-focused scientist.

Q: If you could do a sabbatical with any scientist (living or dead) who would it be and why?
A: Bengt Saltin, PhD. His research interests were just as vast as mine are and really spoke to the integrative nature of exercise physiology. Also, you cannot go wrong with spending time at the Copenhagen Muscle Research Center (CMRC) in Denmark. All the pioneers of exercise physiology had connections to the CMRC.

Q: Briefly, what do you wish the general public understood about science or research?
A: Correlation is not causation.

Q: No. 1 guilty pleasure?
A: Ice cream.

Q: Most influential scientist on your career?
A: Lawrence E. Armstrong, PhD, my graduate adviser for my master's degree.

Q: Favorite science-related TV show (fictional or factual)?
A: "Grey's Anatomy."

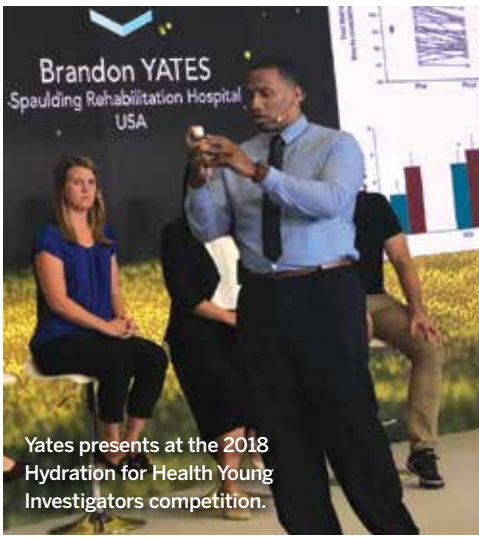
Q: The scientific discovery or invention (made by someone else) that you wish you had made?
A: Blood flow restriction training.

Q: Biggest misconception about physiology/physiologists is … in five words?
A: We all work with rodents.

Q: Favorite way to spend a free hour in quarantine?
A: Lifting weights!

Q: Most valuable quality in a colleague?
A: Ability to offer up a diverse perspective.

Q: Tell us a surprising fact about you.
A: As a strength and conditioning coach, I worked with four professional basketball players.



Yates presents at the 2018 Hydration for Health Young Investigators competition.

Top left and below courtesy of Brandon A. Yates, MS, CSCS; lower left: iStockphoto

Yates, first row squatting in the middle, with his brothers from the University of Connecticut's Heavenly Zeta Lambda Chapter of Phi Beta Sigma Fraternity Inc.

Above courtesy of Brandon A. Yates, MS, CSCS

Q: The question we didn't ask that we should have? A: What is your dream job? Answer: U.S. secretary of health and human services.

Q: Favorite part of your job?
A: Analyzing the data!

Q: Least favorite part of your job?
A: Responding to reviewer No. 2.

Q: Notable scientists you follow on Twitter?
A: Keith Baar (@MuscleScience), @DrDaleNeedham, Dave Hughes (@HughesDC_Muscle) and @NiColeKeithPhD.

Q: Title you'd use on your autobiography?
A: "And I took that personal." (See Michael Jordan's "The Last Dance" for context.)

Q: How would you describe your job to a child?
A: I help people become bigger, stronger and faster.

Q: Favorite charities you support?
A: Fathers and Families

Q: One thing every researcher/scientist should try at least once in their life?
A: To talk to the patients who their research will one day help.

Q: Next book on your reading list?
A: "Outliers" by Malcolm Gladwell.

Q: Favorite TV show, movie series or podcast to binge-watch/listen?
A: "Star Wars."

Q: Favorite musician/musical artist/band?
A: Kirk Franklin.

Q: Go-to snacks to get you through long days working from home?
A: Reese's Cups.

Q: First place you want/plan to visit once pandemic-related travel restrictions are lifted?
A: Anywhere tropical.

Q: City, suburb, country? (Favorite place to live)
A: I'm a city boy.

Brandon Yates, MS, CSCS, is currently a National Institutes of Health-funded doctoral student in the musculoskeletal health sciences program in the Indiana Center for Musculoskeletal Health at Indiana University School of Medicine. His research interests are focused on the neurobiological interactions between skeletal muscle health, brain health and frailty in older adult intensive care unit survivors.

PUBLISH WITH POLISH | OPEN ACCESS

APS Program Bundles Reading and Open Access Publishing

APS launched its Read, Publish, Join (RPJ) transformative subscription model in 2020, bundling reading and publishing under one agreement with the added bonus of a one-year APS membership for new members. In 2021, APS was the first U.S.-based biomedical society to enter into a transitional agreement with Jisc, the U.K. education and technology not-for-profit.

Growing the institutions participating in RPJ allows the Society to offer critical research communities the opportunity to publish open access (OA) with APS journals. Publishing OA makes the article more widely available through immediate, open and free access and allows authors to retain copyright of their work.

Institutions that opt in to an RPJ agreement give their researchers:

- Access to the entire APS Digital Library (10 research journals, two review journals).
- Seamless OA publishing for their institution's corresponding authors.
- A unique one-year APS membership for corresponding authors new to the Society.

Authors simply affiliate themselves with their institution upon submission to APS journals, and the RPJ affiliation flows with the author through their APS publishing journey. If their paper is accepted, an affiliated corresponding author is notified that their work can be published under an OA agreement with their institution. Following publication, authors retain the copyright of the version of record of their article, which is the final and authoritative version of their research paper.

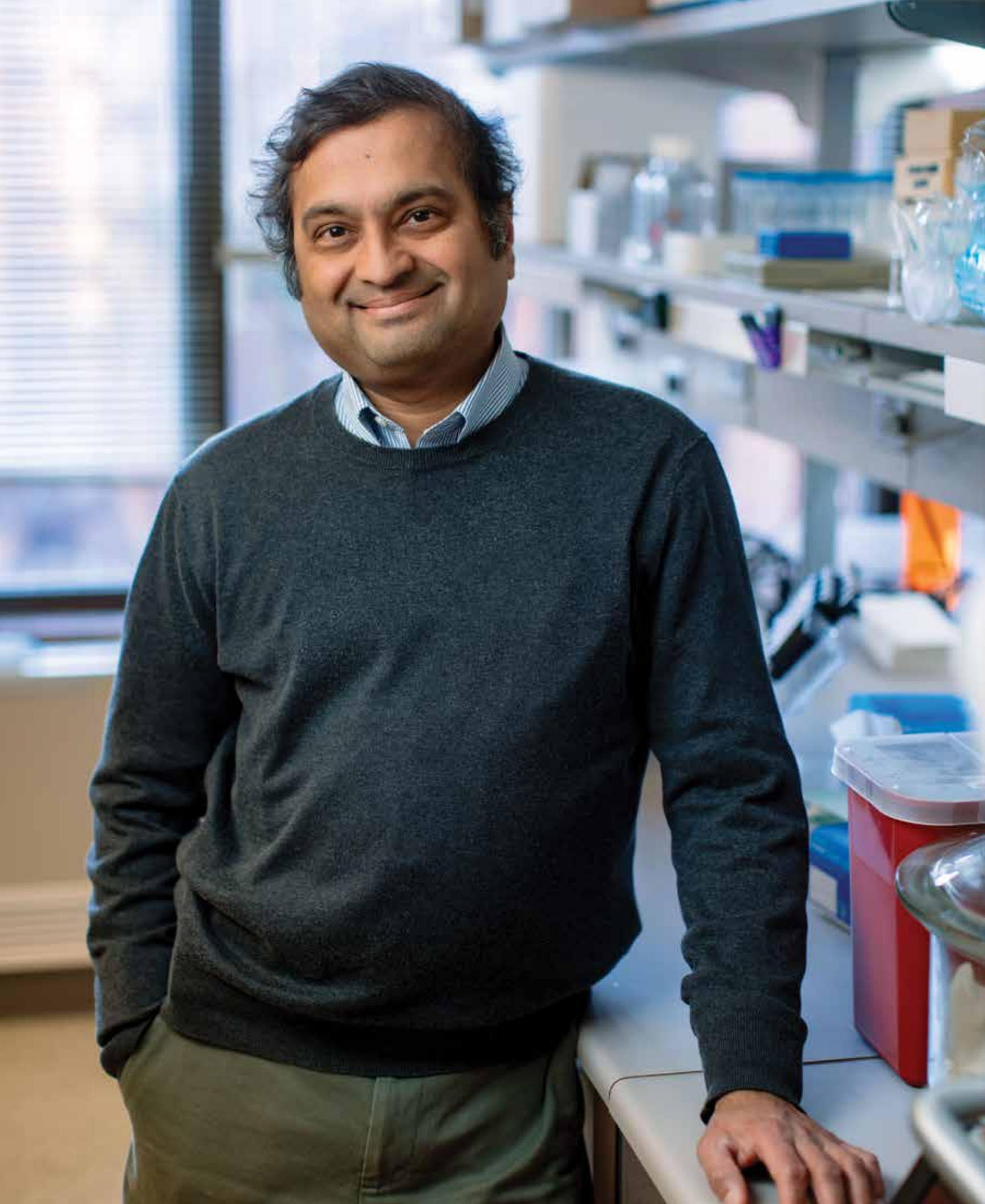
Publishing research through our RPJ model or via APS Open Access helps APS build toward an open science future.

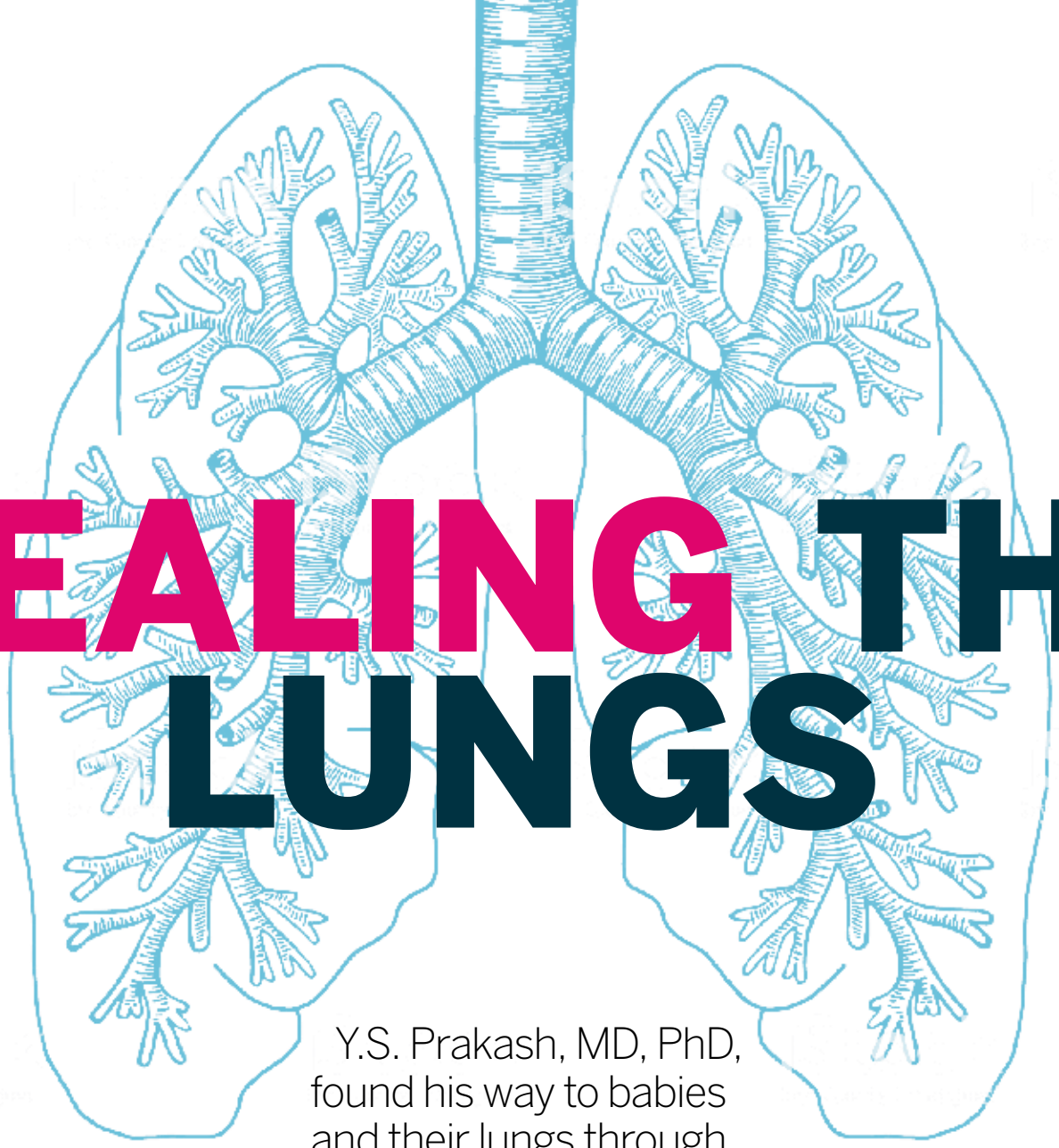
For more information about RPJ and how your institution can enter into a similar agreement, go to **https://journals.physiology.org/librarians.read-publish-join**.

For a list of all RPJ-participating institutions, go to **https://journals.physiology.org/librarians.read-publish-join.participating-institutions**.

To learn the benefits of publishing in APS Open Access, visit **https://journals.physiology.org/author-info.open-access**.

APS' experienced publishing staff share their tips and know-how to help you improve the polish of your scientific manuscripts. Got a scientific publishing or style question that you want us to weigh in on? Email it to tphysmag@physiology.org.



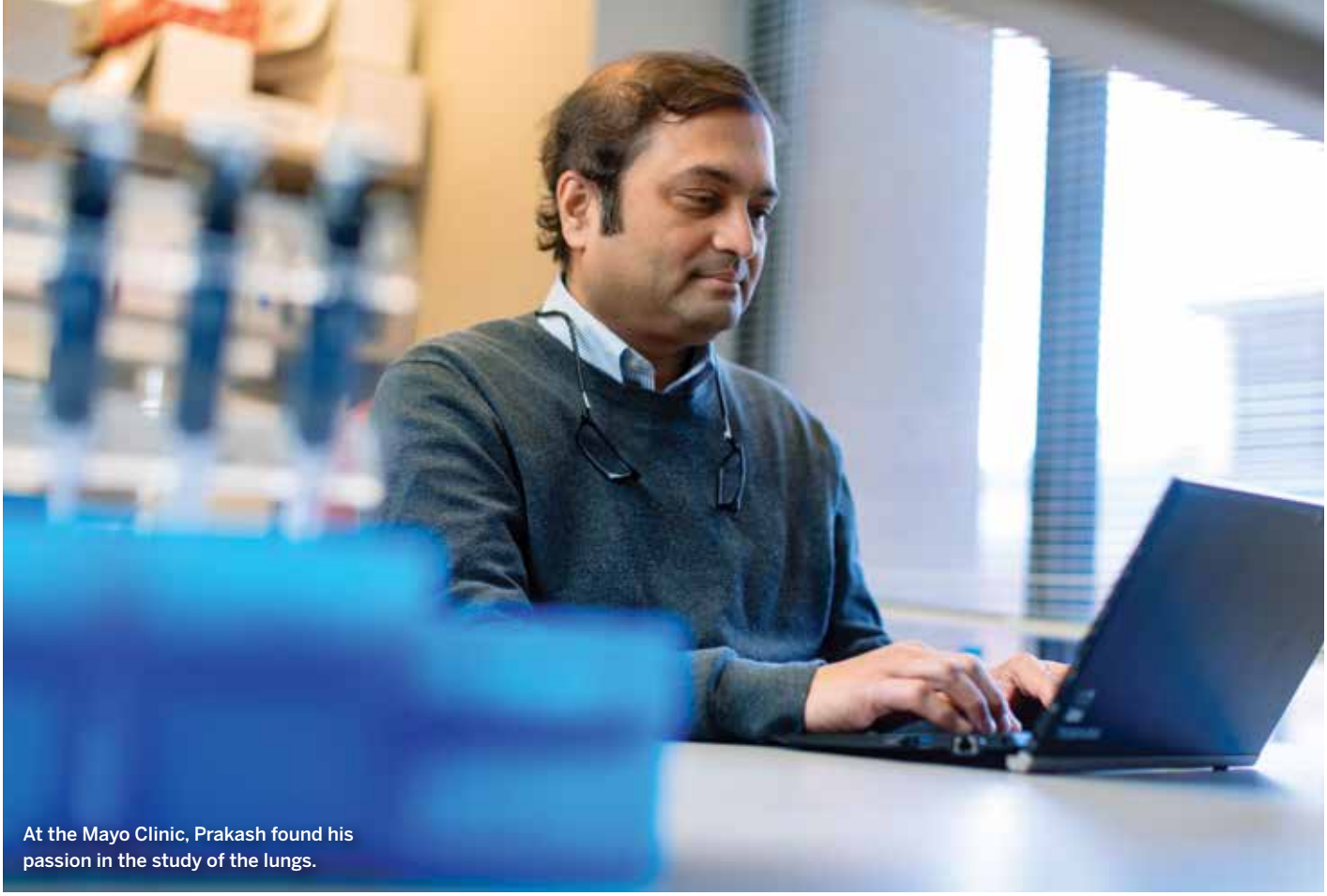


HEALING THE LUNGS

Y.S. Prakash, MD, PhD, found his way to babies and their lungs through serendipitous turns at every stage of his career.

BY JENNIFER NELSON

Y.S. Prakash, MD, PhD, talks about life's forks in the road as casually as deciding between chocolate and vanilla ice cream. "I grew up in the Indian system, and back then, as is now, it's more a British-based system where during high school you decide if you want to go into medical school or engineering, which is the typical split," explains Prakash, professor of physiology and anesthesiology and chair of the Department of Physiology and Biomedical Engineering at Mayo Clinic in Rochester, Minnesota.



At the Mayo Clinic, Prakash found his passion in the study of the lungs.

Fascinated by engineering, but also biology and medicine, Prakash went after both disciplines. He took his entrance exams for the Indian Institutes of Technology and applied to top medical schools. But after he was accepted into both engineering and medical school, he was forced to choose. Though torn, he ultimately chose to go into engineering first—developing an engineering platform with its foundations in critical thinking and analysis—before heading into medicine.

After receiving a scholarship to go to the University of Southern California (USC), Prakash arrived in the U.S. in 1990 to earn a PhD in biomedical engineering. That's where he met former APS President Gary Sieck, PhD, FAPS, a well-known scientist working on neuromotor control. Fascinated by the work, Prakash joined Sieck's lab, but within three months he was presented with another fork in the road. Sieck was heading to the Mayo Clinic. "I could stay at USC and take on a new adviser or move with him."

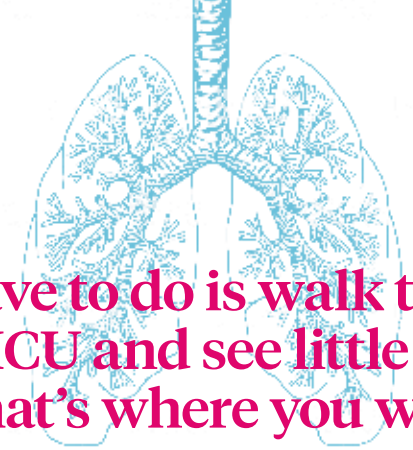
Prakash's department chair at the time—a respiratory physiologist who had recruited him to USC—told him that when you think of any field in medicine that's important, you'll find somebody at Mayo Clinic doing it. That was the motivation he needed. Prakash packed his worldly belongings in the back of his Brazilian-made Volkswagen Fox and drove from Los Angeles to Rochester to join the Mayo graduate school. That was 31 years ago this past summer.

FOLLOWING HIS PASSION

When Prakash arrived at Mayo Clinic, there was no biomedical engineering track. Instead, he entered the physiology track, which was run by a biomedical engineer. Biomedical engineering training, the physiology field and working with Sieck was a good fit, and Prakash earned his PhD in respiratory physiology. During that time, he met Mathur Kannan, PhD, a University of Minnesota faculty member who was doing a sabbatical in Sieck's lab working in airway diseases and asthma.

Working alongside Kannan, Prakash found his passion in the study of the lungs. But, he was equally fascinated by cardiac muscle physiology. Surrounded by the Mayo Clinic environment only heightened his interest in medicine, and working with anesthesiology colleagues inspired him to get his medical degree as well. He began to investigate why anesthetics affect the neonatal heart more than they do the adult heart. Working as a postdoc, Prakash wrote his first R01 grant and applied to medical school.

After he was accepted into medical school, his program officer said he could keep his grant and go to med school. Prakash spent four years at the University of Minnesota Medical School while running his R01 at Mayo. Upon completing medical school, he put his grant on the shelf while he was an anesthesiology resident at Mayo. Meanwhile, he was gravitating toward becoming a lung biologist and wanted



> **"All you have to do is walk through a neonatal ICU and see little preemies and see that's where you want to be."**

to study asthma and airway diseases, so he wrote an entirely new grant once he finished residency. He also married another physician-scientist, Christina M. Pabelick, MD, a pediatric anesthesiologist who was writing a grant of her own.

By 2009, Prakash and his wife—along with an experienced technician, a supportive chair and a small amount of money from the two R01 grants—began a three-person nascent lab doing airway diseases work, studying asthma across the age spectrum.

As they developed their careers exploring adult asthma, they met Richard Martin, MD, of Case Western Reserve University in Cleveland. Martin was a world-renowned neonatologist exploring the impact of premature birth on lung diseases. Prakash and Pabelick had long been passionate about understanding why premature babies who are exposed to oxygen in the neonatal intensive care unit (NICU) or are put on mechanical ventilation get asthma later in life. The new collaboration excited them as they began to pursue this avenue of research, which they have now been doing for the past 12 years.

Prakash wants to understand common versus distinct mechanisms of lung disease across the age spectrum and transfer those ideas from airway diseases to pulmonary vascular disease or other conditions. Some of his team's work includes looking at what happens to the neonatal lung when it gets stretched (as would happen with mechanical ventilation or continuous positive airway pressure therapy, or CPAP). They also want to understand why asthma occurs more in women than in men (boys have more asthma than girls, but women have more asthma than men until menopause), what inflammatory and growth factors contribute to asthma, and why asthma occurs in older people. Separately, ongoing work explores mechanisms of pulmonary hypertension.

A FOCUS ON BABIES

When asked why Prakash wanted to focus on infants and the neonatal lung he says it's because it's not a baby's fault. "All you have to do is walk through a neonatal ICU and see little preemies and see that's where you want to be." The ability to make a lifelong difference lies in early intervention, he says.

There's no such thing as a good amount of oxygen to give to a baby, for example. Giving too little oxygen is bad for the growing baby, but giving too much oxygen, even a little bit, can be detrimental to how the airway grows. It becomes fibrotic and stiffens up, not working as well as the baby grows. Prakash's team has focused on how controlling oxygen makes a big difference. There also may be novel ways to make the airway grow better. Pabelick and Prakash are looking at things such as hydrogen sulfide as an inhaled bronchodilator that might be beneficial in the short or long term.

Instead of placing babies on mechanical ventilators in the NICU, they are placed on nasal CPAPs. However, while that may be helpful early on, it might be harmful in the long run because it stretches what is a very compliant airway, Prakash says. Understanding the impact of stretch on the developing airway is important so medical teams can do only what is minimally necessary to keep the baby healthy as they come out of the NICU.

"It's very, very satisfying to explore some of these concepts," Prakash says. "Obviously, it would be great to do clinical trials, but the threshold for working with babies is a little different than adults."

Therefore, more needs to be done in research labs. "We've gotten to take care of people in our clinical roles, and that's been incredibly satisfying, but it has been equally satisfying to be able to participate in this exciting research, and, importantly, to mentor the next generation of scientists and clinician-scientists," Prakash says. "Today, we have 17 people in the lab, including Christina and me. We are only as good as the people we work with, and we have been simply fortunate to have outstanding people come through."

When Prakash and Pabelick are not conducting research, they love to travel the world, which provides fodder for Prakash's photography hobby. The couple lives in the Minnesota countryside, where they enjoy working in their flower and vegetable gardens.

Prakash's work shows him the preciousness of life. "You learn to appreciate everything you have and make the best of it," he says. "So, we work hard because there's a genuine appreciation for how fragile life is, and making a difference keeps our passion alive."

Illustration by Mark Hess

EYES WIDE OPEN

Sleep is fundamental to human physiology. So, why don't we know more about it? And why are most of us not getting enough?

BY LAUREN ARCURI

No matter our differences, no matter where we are in the world, there's something we all have in common: sleep.

This physiological behavior is fundamental to human well-being. However, it still holds so many mysteries that science has yet to fully uncover. We still don't know the answers to these questions: Why do we have different stages of sleep? What functions do these stages perform? How is sleep restorative to the body?

> **"The joke is 'just sleep more.' Talk to any middle-aged woman who's starting to have sleep issues, or people whose jobs keep them awake overnight, or people with babies and young kids—obviously, there are times when you just can't get enough sleep, or you can't sleep at the right time."**
>
> **—Josiane Broussard, PhD**

We do know how important sleep is. "In order to have normal physiology, normal cognition and normal emotions, we require sleep," says sleep and anesthesia researcher Ralph Lydic, PhD, professor at the University of Tennessee, Knoxville.

The physiology of sleep is tightly tied to our circadian rhythm—a natural, 24-hour cycle that plays a role in when we are awake and asleep. It's a carefully orchestrated symphony of our hormones and genetics, primarily influenced by light. As humans, our circadian rhythm is diurnal, meaning we are generally active during the day and asleep at night.

We need a consistent amount of high-quality sleep that occurs at night in sync with our circadian rhythm. However, for many of us, sleep quality is poor or happens at the "wrong" time. More than one-third of adults in the U.S. get less than seven hours of sleep a night, the minimum recommended by the American Academy of Sleep Medicine. More than two-thirds of U.S. high school students report getting less than eight hours of sleep on school nights, according to the Centers for Disease Control and Prevention. Further, 1 out of 5 people work what is considered "non-standard" hours, which typically requires sleep at the "wrong" time of day.

SLEEP AND HUMAN HEALTH

The consequences of this chronic sleep deprivation may be profound. "We know sleep deprivation does terrible things to our physiology," Lydic says. "Four nights of five hours of sleep or less, which is very common in medical residency training, very common if you're a first responder, a young parent—very common for many of us—causes cognitive dysfunction that is equivalent to a blood alcohol level of 0.06. So it really, really matters."

Human sleep is characterized by a sleep cycle made up of four distinct phases or stages. In one night, a person typically goes through four to six total sleep cycles. The cycle begins with stage 1, basically "dozing off," which usually lasts only one to five minutes. As the person falls asleep, they enter stage 2: their body temperature drops, their muscles relax, their brain activity diminishes and their breathing and heart rate slow. This stage can last 10 to 60 minutes.

Stage 3 sleep, which usually lasts 20 to 40 minutes per cycle, is also known as deep or slow wave sleep. During this time, thought to be important for repair and restoration, the brain's activity is characterized by a type of brain wave called delta waves. As we emerge from deep sleep, we enter stage 4 or rapid eye movement (REM) sleep, when brain activity picks up and the body's muscles (except eyes and breathing muscles) experience sleep paralysis. This is the phase of sleep when we dream, and it typically lasts 10 to 60 minutes per cycle.

Lisa Marshall, PhD, professor at University of Lubeck in Germany, studies memory consolidation during sleep. She points out that people who are chronically sleep-deprived are usually unaware of the detrimental effects of it on things such as their reaction time, which could result in dangerous situations such as driving while sleep-deprived.

Marshall's lab is learning that it's not just one phase of sleep, such as slow wave or REM, that is important to memory consolidation but the interaction of those two sleep phases that seems to facilitate the process. What's clear already is that sleep is deeply involved in memory formation, she says.

Research has shown that if we don't get enough sleep, or we get sleep that is out of sync with our circadian rhythm, the consequences are significant for our mental and physical health. People who are out of sync with their body clocks are more likely to feel depressed, anxious or fatigued, according to a June 2021 study in *Molecular Psychiatry.*

Studies have also shown that people who chronically sleep less than seven hours are at an increased risk for diabetes, obesity and cardiovascular disease.

"We've known for a little while, about a decade or two, that sleep is important, not just for the brain, which historically was the perception, but also really important for whole body health," says Josiane Broussard, PhD, assistant professor at Colorado State University. Broussard's research focuses on how sleep and circadian disruption affect metabolism. Some of her latest work studies the impact of insufficient sleep on insulin sensitivity. Previous research showed that insufficient sleep impairs insulin sensitivity at the whole body level. Broussard and her colleagues followed that process down to the cellular level, finding a reduction in insulin signaling in the fat cell itself.

Follow-up research suggests that based on the upregulation of genes involved in fatty acid processing and downregulation of genes involved in glycolysis, "a fuel switch might happen with sleep and circadian disruption," Broussard says. "Basically, the muscle could upregulate its use of fat for fuel when people are sleep restricted." That fits with previous research her team has done, which found that adipose tissue is less sensitive to insulin when someone is sleep-deprived and that both sleep and circadian disruption result in increased free fatty acids in circulation.

It's generally accepted knowledge that sleep loss leads to higher levels of the "hunger hormone" ghrelin in the blood, Broussard says. "You're likely to eat more food, and you're more likely to crave higher reward foods like sweets and treats."

While lack of sleep clearly affects metabolism, the effects of sleep and circadian disruption are widespread across body systems. "There's hardly a hormone that's not impacted," she says. "It's quite striking, actually."

Artificial lights via screens and work hours that don't respect circadian rhythms are causing us to lose sleep. We're also fighting an uphill battle as aging itself affects our sleep. As we grow older, our circadian rhythm becomes less pronounced. That's why older adults sleep more poorly.

"We have this 24-hour rhythm [that] our body does, a cycle that has a large positive and negative amplitude to it," Marshall says. "This amplitude is somehow decreased as we age so that it's more difficult to sync your sleep behavior to your current physiological rhythm."

What's more, as people age, they get less of what we call deep sleep or slow wave sleep. Jason Carter, PhD, a professor and vice president for research, economic development and graduate education at Montana State University, says, "Slow wave sleep slowly decays as we age. And yet, it's such an important stage of sleep. We've now seen how even our brain gets flushed out when we're in deep sleep and might help prevent or delay things like Alzheimer's disease."

"A lot of people view sleep as a waste of time. We believe things like sleeping a lot is a sign of weakness. It shouldn't be seen that way. Some people do need to sleep more than others, and that's just your body."

—Jason Carter, PhD

"We Americans are wonderfully pragmatic, but to a fault. We justify everything by saying, 'well, it helps us do better work.' But what about quality of life? And what about our health? What about all the other things that make us human?"

—Ralph Lydic, PhD

Although researchers have found the connections between lack of quality sleep and poor health, they have not yet been able to find medications that help us achieve "normal" sleep architecture, including the important slow wave or deep sleep. A May 2021 study in the *British Medical Journal* found that prescription medications for sleep disturbances did not help midlife women sleep better over a two-year follow-up period. "Sleeping pills are a suboptimal solution," Marshall says. "Not only is deep sleep not facilitated, but most of the time they don't induce REM sleep, either—only light, non-REM sleep."

ENTER THE PANDEMIC

The coronavirus pandemic that began in early 2020 changed many people's sleep habits and patterns—for better and for worse, scientists have found. Carter and his colleagues published research in October 2020 in *Biology of Sex Differences* analyzing the impact of state-mandated lockdowns on anxiety and sleep quality and comparing the differences between women and men. The lockdowns led to increased anxiety and reduced sleep quality for men and women, but the effect was more pronounced for women with respect to anxiety.

A number of studies quantified the impact of the pandemic on sleep. One out of Washington State University and published in April 2021 in *Frontiers in Neuroscience* looked at twins during the pandemic. One-third of subjects slept less, while another third slept more—but any change, whether more or less sleep, was associated with changes in self-reported mental health status. A meta-analysis in the *Journal of Clinical Sleep Medicine* in February 2021 found that 40% of people reported sleep problems during the pandemic and people with active COVID-19 had higher rates of sleep problems. In another study in *Lancet Psychiatry* in May 2021, as many as one-third of COVID-19 survivors reported insomnia.

While several studies found that adolescents slept more during the pandemic, often due to remote learning start times being more flexible, a study in *PLOS One* in April 2021 found that remote learning actually led to less sleep, as students had less exposure to sunlight and their circadian rhythms became delayed.

Will the changes that have been beneficial, such as later or more flexible work and school start times, survive as we shift to a "new normal" and return to in-person school and work? "It will be interesting if people end up getting better sleep because so many more people are working from home and have less of a time requirement to get up and commute. That would be my hope," Broussard says. "That would be a really positive outcome. Now that people are given a little more freedom to live by their natural biological clocks, rather than by an imposed work clock, keeping some of that might make sense."

"It will be interesting to see how people respond," Carter says. "Will the individuals that were able to consolidate and prioritize sleep a little bit more continue with that in a post-pandemic world? I hope they will. But I think the anxieties of COVID-19 really had more of a detrimental impact on sleep than the positive."

HOW TO IMPROVE SLEEP

Since it's clear many of us are sleeping less than optimally—whether that's too few hours, inconsistent sleep, circadian disruptions like early or swing shifts, or lack of deep sleep—what can we do to improve our sleep? Right now, most of what we know is that our sleep habits contribute to our sleep quality: timing, consistency and making sure we sleep seven to eight hours every night. But changing those things isn't always a simple matter.

"The joke is 'just sleep more,'" Broussard says. "Talk to any middle-aged woman who's starting to have sleep issues, or people whose jobs keep them awake overnight, or people with babies and young kids—obviously, there are times when you just can't get enough sleep, or you can't sleep at the right time."

It's also important to recognize that some factors, such as shift work, tend to disproportionately affect people in lower socioeconomic classes and historically marginalized communities.

These less-than-ideal sleep behaviors are unavoidable at times. Broussard's lab is aiming to answer the question what can we do to reduce the risk that we know exists for increased diseases with sleep and circadian disruption?

"We're looking at whether you can 'pay back' a sleep debt by extending your sleep—to see if it improves metabolic homeostasis," she says. Another study looks at whether someone who's sleep restricted can offset some of those negative effects with exercise. Yet another is delving into whether manipulating food timing in relationship to circadian rhythms helps mitigate the effects of shift work. "We're asking if moving food intake outside of the nighttime period, without reducing food amount, might reduce some of the health risk" associated with shift work, Broussard says.

Carter sees these questions as the ones at the heart of the field of sleep research moving forward. "I think that a big question is how do we leverage technology? We know how bad technology, like smartphones, has been for sleep," he says. "But how can we leverage technology to actually help us with sleep?" Wearables and trackables are beginning to get better and better at monitoring our sleep, helping us track the impact of changes to our sleep routines and habits in both quality and quantity.

It's also important for society to recognize that sleep is just as important a part of health as regular physical activity and good nutrition, Carter says. "Sleep is the third pillar of health, and it's cost-effective to improve it, and we don't emphasize that enough. I think there's an unprecedented opportunity to take advantage of behavioral modifications that don't cost a lot of money that can have huge impacts."

Culture is also at play. "A lot of people view sleep as a waste of time," Carter explains. "We believe things like sleeping a lot is a sign of weakness. It shouldn't be seen that way. Some people do need to sleep more than others, and that's just your body. We need people to feel comfortable with getting the amount of sleep that's right for them." While that's seven or eight hours for most of us, a few people can do fine on five or six hours, while others need nine, 10 or even 11 hours to function optimally.

"We Americans are wonderfully pragmatic, but to a fault," Lydic says. "We justify everything by saying, 'well, it helps us do better work.' But what about quality of life? And what about our health? What about all the other things that make us human?"

One strength that sleep research has, Lydic says, is its multidisciplinary nature. Sleep cuts across all disciplines because it affects everything about us, our entire physiology and all our systems. "I think many people are excited about computational biology combined with physiology," he says. "I think this is going to allow people to make really big advances. Many of us grew up looking at XY, two-dimensional relationships. And now we have the computational power to look at many, many interacting relationships."

With this power we may finally have the tools to untangle the remaining mysteries of the complex, multi-system phenomenon of sleep.

Sleep Resolutions of Sleep Researchers

The Physiologist Magazine asked these sleep researchers: If you had one "sleep resolution" you could make to improve your own sleep, or one that you would suggest to someone who was having trouble sleeping well, what would it be?

Jason Carter, PhD, Montana State University

"The easiest and most effective is to cut out electronics a minimum of one hour before going to bed. Come up with a new routine. Maybe that's going back to the old-fashioned reading a book; maybe it's listening to music; maybe it's getting clothes ironed and ready for the next day. But disconnect from TV and electronics one to two hours before bed."

Josiane Broussard, PhD, Colorado State University

"I just love watching shows at night. My sleep resolution would be to put my phone outside my room and stop watching shows two hours before bedtime."

Lisa Marshall, PhD, University of Lubeck, Germany

"My resolution would be to get into a regular schedule with an earlier bedtime." Both consistency in one's sleep schedule and going to sleep early are important to sleep health, Marshall says.




THE REMIX

Labs are reopening after COVID-19 shutdowns, but will the workplace ever look like the "before times" again?

BY DARA CHADWICK



In March 2020—as COVID-19 infections began to rise in the U.S.—physiology laboratories at academic institutions faced an unprecedented on-campus situation: Classes canceled. Labs shuttered to all but critical personnel. Animal models lost, and research slowing down and, at times, slipping off track completely.


Illustration by Olga Kurbatova/iStockphoto

“We don’t have the same foot traffic we used to have. But it’s nice to see people in the halls because it was a ghost town for a long time.”

—William Jackson, PhD, FAPS

While scientists are no strangers to uncertainty, the COVID-19 pandemic’s complete disruption of lab life had even the most intrepid researchers asking, “Will things ever get back to normal?” Now, 18 months later and with many staffers and students vaccinated, the answer is … maybe. While labs have reopened and students are returning, “normal” doesn’t necessarily look the same as it once did.

William Jackson, PhD, FAPS, professor of pharmacology and toxicology at Michigan State University (MSU) in East Lansing and an APS Councilor, says that “normal” at MSU has included an online daily health check-in asking people to attest that they weren’t experiencing COVID-19 symptoms (voluntary attestation of COVID-19 vaccination was added in early June 2021). These daily check-ins, part of the university’s reactivation plan launched in June 2020, stayed in place through June 28, 2021, Jackson says.

As of July 2021, fully vaccinated individuals were no longer required to wear masks or social distance. Students, faculty and personnel are welcome to return to the lab full time, and research can return to business as usual. But has it?

Not exactly, Jackson says. “The labs are still not as active as they were pre-COVID,” he says. “Our building is now locked 24/7, and you have to have key card access to get in. We don’t have the same foot traffic we used to have. But it’s nice to see people in the halls because it was a ghost town for a long time.”

Jackson says he’s primarily a lab of one, studying cerebral circulation, particularly arterioles in the brain and their involvement in disease states such as hypertension and obesity. The lab’s physical space includes six microdissection stations where researchers remove arterioles from tissue. But Jackson also runs part of the department’s imaging center, and his two lab spaces—at just under 1,000 square feet collectively—are home to a confocal microscope and two photon microscopes. “That’s department equipment that I supervise,” he says, adding that researchers use the equipment all the time. “So even though my lab is small, there’s a lot of activity.”

During initial COVID-19 closures from March through June 2020, the lab was completely closed except for people coming in to maintain animal protocols. “The lab I collaborate with uses a high-fat feeding model of obesity,” Jackson says. “That was the only thing that was really kept going during COVID.”

Jackson says he also faced challenges in maintaining the imaging equipment during closures. “The equipment needs to be maintained at the right temperature,” he explains. “They have chillers associated with them, and they run out of cooling solution, not frequently, but not in a predictable fashion because it depends on use and room temperature. There were a few people coming in to use the microscopes to do experiments with animals that were already in process and needed to be studied at a particular time.”

While some work continued this past year, other experiments were lost, Jackson says. “We had a small

colony of mice that expressed a calcium indicator in their endothelial cells so we could study calcium regulation," he says. "We lost those during the shutdown. People couldn't get in to take care of them, and we were under a no-breeding mandate. No new animals were coming in, and for the experiments we were doing, we needed them at certain ages. We lost the whole colony, and we've had to completely change how we're going to do this project we're working on. It's basically knocked us back about two years."

ADAPTING FOR SAFETY

As MSU implemented its reactivation plan throughout the summer and fall of 2020, two people were allowed to be in the lab at the same time, Jackson says. That allowed research to continue, but at a much slower pace. "Now, we're back up to five days a week," he says. "We've adapted, and we're just working on different aspects of the same project, trying to get the other stuff going as we can."

Initially, MSU mandated that any work that could be done at home should be, Jackson says. Now, the option to work remotely remains in place for those who aren't comfortable returning to work in person. Some class sizes may be adjusted, he adds, noting that "enormous lectures" may be reduced, and some hybrid class models may be used.

MSU has also implemented "Spartan Spit," a weekly mandatory saliva-based assay to screen all students for COVID-19. Faculty and staff can choose to be screened too. "A lot of people in our department have elected to do it, including myself," he says.

One thing that doesn't seem to be changing at many institutions is the physical layout of laboratory space. While physical distancing has been shown to help prevent the spread of COVID-19 among unvaccinated people, most managers say they have relied on policies such as staggered schedules and remote work to help researchers keep their distance from each other.

"We haven't made any changes in the physical layout of the laboratory, but I'm still encouraging people who are writing to do that at home," says Bonnie Blazer-Yost, PhD, professor of biology at Indiana University–Purdue University Indianapolis. "All the graduate students have really stepped up and are quite busy. I trust them to just go home and do the work they need to do if they can do that."

Blazer-Yost's lab includes three graduate students and one undergraduate who are using animal models of hydrocephalus to study cerebrospinal fluid production via electrolyte transporters found in tissue called the choroid plexus. "What we're trying to do is make progress toward finding a drug treatment for hydrocephalus," she says.

The work includes a lot of data analysis and writing that can be done remotely. But keeping the breeding colony going and genotyping the litters when they're born is critical to the lab's model of pediatric hydrocephalus. "The animals don't live past day 20, so they have to be genotyped shortly after they're born so we know who's affected and who's not," Blazer-Yost says. "All of the people in my lab are fully vaccinated so we've felt a bit more comfortable with having everybody come back to work."

While a fully vaccinated lab team brings some measure of comfort, it's important to consider options for when that might not be the case. Marilee Lloyd, AIA, an architect and senior laboratory planner with the national architecture and engineering firm HED in Southfield, Michigan, says that while safety has always been paramount in designing research laboratories, COVID-19 has added more dimensions to consider.

One consideration typically reviewed but that has taken on added importance is making sure there are enough air changes in the lab so that any particulates properly leave the space, she says. "We typically spend a little time visioning a space with our clients to understand what their strategic goals are so we know how flexible an environment to target. We consider what type of science is being done and apply the most appropriate module, which is a way of making the space more amenable to change, flexibility and adaptability."

"All the graduate students have really stepped up and are quite busy. I trust them to just go home and do the work they need to do if they can do that."

—Bonnie Blazer-Yost, PhD

> **"If we hadn't had as severe a lockdown, people would have continued their ongoing projects and never thought of writing such pieces."**
>
> **—Bina Joe, PhD**

Those conversations with clients help Lloyd make decisions about equipment such as HVAC systems and the need for overall flexibility in the environment. For example, a modular approach can give laboratories the ability to move some benching to create space or to move in a larger piece of equipment.

Another consideration for lab design in a post-COVID–19 world is the density of the laboratory, Lloyd says. "How many research staff are working there?" she says. "Is the work more analytical, with more instruments and fewer people working? Will staff set up an experiment and monitor it from elsewhere?"

If changing a lab's layout isn't practical, institutions can make process changes to help protect workers from spreading infection. For example, Lloyd says, as a response to COVID-19 she's seeing labs encourage workers to take fresh eye protection when entering the lab instead of reusing safety glasses. There's also more focus on a daily wipe-down of laboratory equipment and one-way travel, she says, adding that she's also been approached about putting up plexiglass between lines of benching to create barriers. Her firm is also seeing a greater interest in touchless fittings in laboratories, such as foot pedals and electronic sensors.

Lloyd says conversations with clients designing new laboratory spaces often include a discussion of COVID-19 nowadays. "Both from the institutional perspective and our own as designers, we're all still understanding where we're going to be in a year or five years," she says. "Early on, we didn't know the efficacy of these vaccines, so we didn't know how that was going to impact us—or not—in the long term."

FLEXIBILITY REQUIRED

Creating flexibility in physical space is one component of physiology lab work post-COVID–19. But flexibility in research—and in thinking—has proved just as valuable. Bina Joe, PhD, distinguished university professor and chair of the Department of Physiology and Pharmacology at the University of Toledo College of Medicine and Life Sciences in Ohio, pivoted quickly to help her team stay productive during pandemic closures.

"I thought, 'how can we engage trainees with their brilliant minds to get publications?'" Joe says, adding that the bioinformatics team in her lab was working on machine learning for cardiovascular diseases. "We switched and asked if machine learning could be used to predict COVID-19."

The work was published in April 2020 in the APS journal *Physiolgical Genomics* and was cited more than 150 times and downloaded more than 32,000 times. "So, I charged all the trainees to think of what else they could publish with the data they had," she says. "All of a sudden, people were thinking, 'what is this new disease and what do we have from the lab that we can contribute to the literature?' One of the postdocs came up with the idea that we have data from germ-free rats compared to germ-full rats and that microbiota may be contributing to the severity of COVID or susceptibility of COVID."

The postdoc published a rapid report in the journal *Hypertension* in May 2020—an opportunity that grew specifically from the lockdown, Joe says. "If we hadn't had as severe a lockdown, people would have continued their ongoing projects and never thought of writing such pieces," she says. "The productivity in our department went up really fast. We had the highest number of publications this year."

With vaccines encouraged, Joe's department was back to full in-person capacity as of July. Masking and physical distancing mandates had been lifted. In fact, the only lingering issue Joe sees is a potential dip in international student enrollment. "Although travel is permitted, students are facing hardships obtaining their visas," she says.

Another issue lab leaders are watching closely is COVID-19 variants, such as the Delta variant. "Like most scientists, I'm watching it very carefully," Blazer-Yost says. "I'm sure the university is as well. As scientists, we can all assess the guidelines. It's amazing how the scientific community has come together and developed the vaccines. It makes one proud to be a scientist."

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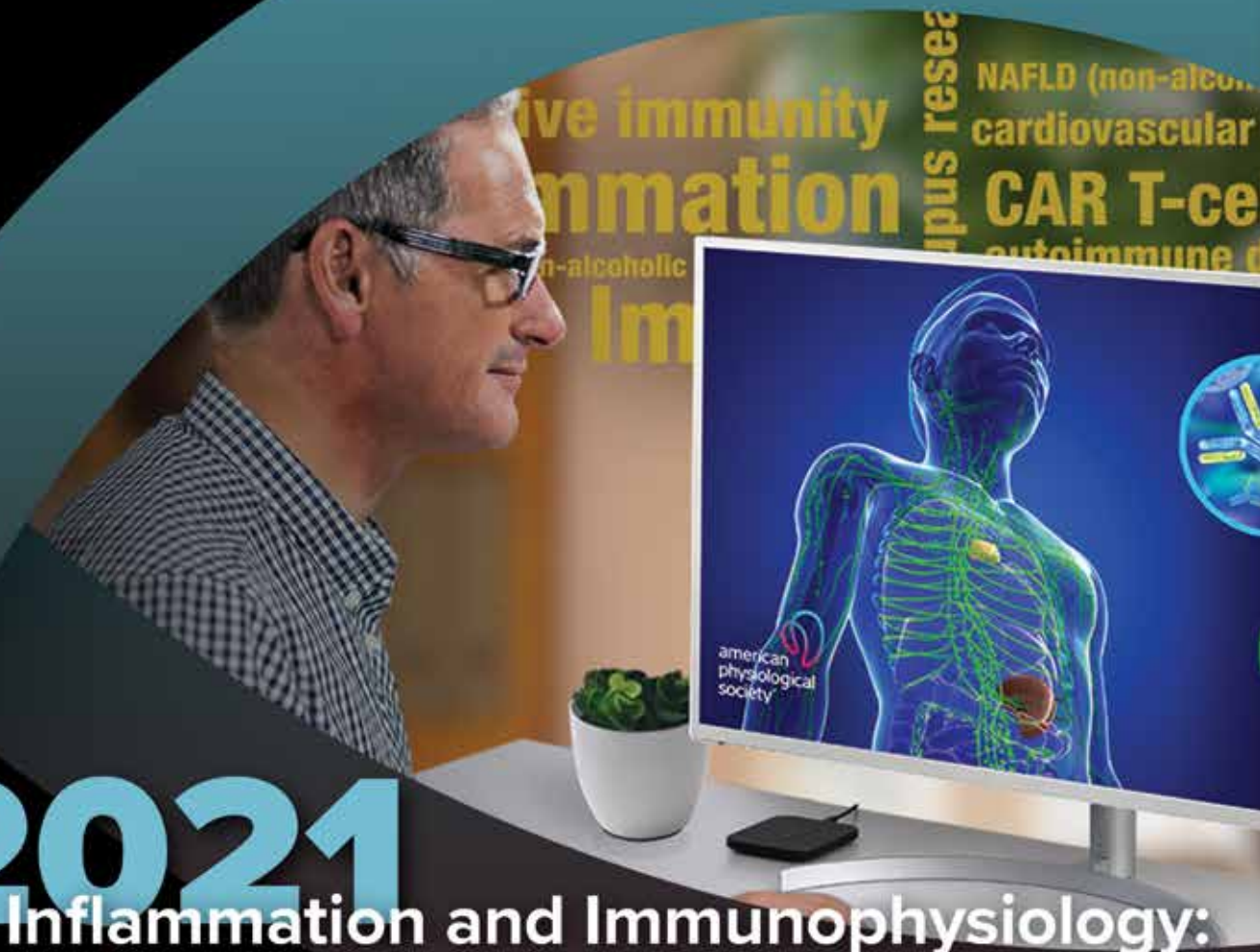


2021 Inflammation and Immunophysiology: An Exploration of Pathophysiology

The American Physiological Society is excited to announce our new webinar series covering fundamental principles, late-breaking research and novel discoveries in the field of inflammation and immunophysiology.

Research topics covered in this series will include:

- Regulation of inflammation via lymphatic microvasculature
- Cardiovascular consequences of inflammation
- Innate versus adaptive immunity
- Mechanisms of cancer immunology and advanced treatments
- Mechanisms of autoimmune diseases and treatments
- Non-alcoholic fatty liver disease (NAFLD) and steatohepatitis (NASH)
- Aging and inflammation

Register today at:
physiology.org/webinars/immunophysiology

APS Members Selected as Inaugural IUPS Fellows

The International Union of Physiological Sciences (IUPS) has announced its inaugural class of Honorary Fellows and Fellows of the IUPS Academy of Physiology. Honorary Fellow, IUPS' highest honor, recognizes physiologists who have been awarded "worldwide recognition and acclaim." Fellow status is conferred to those who have made exceptional contributions to the physiological sciences. The following APS members were elected to the 2021 class of IUPS Fellows:

Honorary Fellows:

Erwin Neher, PhD, Nobel laureate, research director emeritus, Max Planck Institute for Biophysical Chemistry, Germany

Fellows:

Sue C. Bodine, PhD, FAPS, professor of medicine and Fraternal Order of Eagles Diabetes Research Chair University of Iowa Carver College of Medicine

Barbara Cannon, PhD, professor emeritus in physiology, Stockholm University, Sweden

Shu Chien, MD, PhD, FAPS, University Professor Emeritus of Bioengineering and Medicine, University of California San Diego

Allen W. Cowley Jr., PhD, FAPS, Harry & Gertrude Hack Term Professor of Physiology, Medical College of Wisconsin

Sandra T. Davidge, PhD, Distinguished University Professor, Departments of Medicine and Dentistry, Obstetrics and Gynecology, and Physiology, University of Alberta, Canada; executive director of Women and Children's Health Research Institute, Alberta, Canada

Dario DiFrancesco, PhD, professor emeritus, University of Milano Department of Biosciences, Italy; professor of biophysics and physiology, San Raffaele University, Italy

Jens Leipziger, MD, professor of biomedicine and physiology, Aarhus University, Denmark

A. D. C. "Tony" Macknight, MD, PhD, emeritus professor; director of education, ADInstruments Inc., New Zealand

Denis Noble, FRS, emeritus professor, University of Oxford, U.K.

Ole Petersen, CBE, FRS, professor, School of Biosciences, Cardiff University, U.K.; director of Academia Europaea, Cardiff University Knowledge Hub; editor-in-chief of *Function*

Amal Mahmoud Saeed, PhD, professor of medicine, University of Khartoum, Sudan

Barman Named Distinguished Professor

Susan Barman, PhD, FAPS, a professor in the Department of Pharmacology and Toxicology in the College of Human Medicine at Michigan State University (MSU), has been named a university distinguished professor. The title is the highest faculty honor at MSU and recognizes "exceptional teaching abilities, prominent record of public service and scholarly, creative and artistic achievements." Barman was the 85th president of APS and has been member of the Society since 1975.

Day Receives University of Calgary Alumni Awards

Trevor Day, PhD, a professor at Mount Royal University in Calgary, Canada, is the recipient of two alumni awards from his alma mater, the University of Calgary in Canada. He was named the Hotchkiss Brain Institute's (HBI) Neuroscience Alumnus of the Year for 2019—an award that recognizes HBI's outstanding former trainees—and received the 2020 Alumni of Distinction Award from the Cumming School of Medicine. Day's current research is in integrative cardiorespiratory and cerebrovascular human physiology, including high-altitude research expeditions. He has been an APS member since 2007.

Houser Receives American Heart Association Gold Heart Award

Steven Houser, PhD, FAHA, senior associate dean of research, Vera J. Goodfriend Endowed Chair of Cardiovascular Research, and chair and professor of physiology at Temple University in Philadelphia, is the 2021 recipient of the American Heart Association's (AHA) highest volunteer honor, the Gold Heart Award. Houser has served AHA in a variety of volunteer positions for more than 35 years, including as president, a member of the board of directors and chair of several committees. He has been an APS member since 1978.

Incognito Receives Governor General's Gold Medal

Anthony Incognito, PhD, is a 2021 recipient of the University of Guelph in Canada's Governor General's Gold Medal. This award recognizes outstanding academic excellence and teaching contributions by a graduate student. Incognito is a postdoctoral fellow in cardiovascular physiology at the University of Calgary, Canada. His research includes expanding the understanding of how baroreflexes and chemoreflexes work to maintain blood pressure and blood chemical status. Incognito has been an APS member since 2016.

Kregel Becomes New FASEB Board President-elect

Kevin C. Kregel, PhD, FAPS, became the new Federation of American Societies for Experimental Biology (FASEB) Board president-elect on July 1. Kregel is executive vice president and provost at the University of Iowa. He previously served as chair of the FASEB Science Policy Committee's Animals in Research and Education Subcommittee from 2008 to 2018. Kregel has been an APS member since 1988.

Matalon Receives Dean's Excellence in Research Award

Sadis Matalon, PhD, FAPS, Distinguished Professor and Alice McNeal Endowed Chair of Anesthesiology and director of the Division of Molecular and Translational Biomedicine at the University of Alabama at Birmingham (UAB), is the senior faculty recipient of UAB's 2021 Dean's Excellence Award in Research. The award "celebrates a story of a distinguished life of science" and acknowledges collaboration and dedication to students and mentees. Matalon is a past editor-in-chief of the *American Journal of Physiology-Lung Cellular and Molecular Physiology* and is the current editor-in-chief of *Physiological Reviews*. He has been an APS member since 1976.

Meier Named to Washington State Academy of Sciences

Kathryn Meier, PhD, FAPS, professor and associate dean for faculty and student development at Washington State University (WSU), has been named to the Washington State Academy of Sciences. Meier received this honor in recognition of her leadership in cancer research and for advancing STEM education at WSU. She has been a member of the Society since 1997.

Spires Wins Summa Cum Laude Prize in Physiology

Denisha Spires, PhD, is the 2021 recipient of the Medical College of Wisconsin's Summa Cum Laude Prize in Physiology. The award is given annually to a member of the graduating class in recognition of the highest level of academic and scientific achievement. Spires, a postdoctoral fellow at the Medical College of Georgia, studies the pathophysiological role of ion channels in the kidney and on the progression of renal disease in relation to mitochondrial dysfunction. She has been an APS member since 2016.

OPPORTUNITY KNOCKS

Check out this featured job listing. To find your next career opportunity or to list your job announcement with us, visit www.physiology.org/jobs.

RESEARCH SCIENTIST III, PHARMACOLOGY

CYTOKINETICS

Cytokinetics, a late-stage biopharmaceutical company, seeks applicants for the position of research scientist III in pharmacology. The individual will join a dynamic group supporting multiple projects for therapeutic application to cardiovascular and skeletal muscle diseases. **Read more at www.physiology.org/cytokenetics.**

APS FELLOWS

APS Welcomes Class of 2021 Fellows

The following members have recently been awarded the prestigious status of Fellow of the American Physiological Society (FAPS). FAPS honors distinguished leaders who have made significant contributions to physiological sciences and related disciplines and have served the Society for at least 15 consecutive years. Congratulations to the Class of 2021!

Melissa Bates, PhD, FAPS (University of Iowa)
Marni Boppart, ScD, FAPS (University of Illinois at Urbana Champaign)
Bruno Grassi, MD, PhD, FAPS (University of Udine)
Justin Grobe, PhD, FAPS (Medical College of Wisconsin)
Dan Halm, PhD, FAPS (Wright State University)
Mark Hargreaves, PhD, FAPS (The University of Melbourne)
William Jackson, PhD, FAPS (Michigan State University)
Sonnet Jonker, PhD, FAPS (Oregon Health & Science University)
Christos Katsanos, PhD, FAPS (Arizona State University)
Merry Lindsey, PhD, FAPS (University of Nebraska Medical Center)
Wallace MacNaughton, PhD, FAPS (University of Calgary)
Susan Marsh, PhD, FAPS (Washington State University)
Gustavo Nader, PhD, FAPS (Pennsylvania State University)
Rhonda Prisby, PhD, FAPS (The University of Texas at Arlington)
Marion Siegman, PhD, FAPS (Thomas Jefferson University)
Volker Vallon, MD, FAPS (University of California, San Diego)
Loren Wold, PhD, FAPS (The Ohio State University)

RECOGNITION

APS Wins Awards for Excellence in Marketing and Communications

APS has been recognized with eight awards for excellence, including two awards of the highest recognition for *The Physiologist Magazine*. The awards were given by two organizations in the areas of marketing and communications.

The AM&P Network EXCEL Awards recognize excellence and leadership in association media, publishing, marketing and communications. This year, 81 Gold Awards, 84 Silver and 75 Bronze were handed out.

APS was among the most decorated membership association for the prestigious awards program. The Society won recognition in the following categories:

Gold Award—The *Physiologist Magazine*, Magazines General Excellence for 10,000 or fewer circulation category

Gold Award—"Gene Screen," feature article in the January 2020 issue of *The Physiologist Magazine* highlighting the research of member Andrea Meredith, PhD, and written by Managing Editor Melanie Padgett Powers, Feature Article for 10,000 or fewer circulation category

Silver Award—I Spy Physiology Blog, "Why COVID-19 Makes It Hard to Breathe," Blog, Blog Single Post category

Silver Award—APS Twitter Feed, Best Social Media Feed category

Silver Award—End-of-Year Fundraising Direct Mail Campaign, Direct Mail-Campaign category

Silver Award—Membership Brochure, Brochure category

Bronze Award—APS News Update, Newsletters General Excellence category

Communications Concepts' APEX Awards are based on excellence in graphic design, editorial content and the ability to achieve overall communications excellence. APEX Awards of Excellence recognize exceptional entries in each of the individual categories. APS was recognized with the following award:

Award of Excellence—*The Physiologist Magazine*, September 2020 issue, COVID-19 Media-Health and Medical category

"Many top-notch associations submit their work to these highly competitive awards," said APS Chief Community and Learning Officer Meeghan De Cagna, MSc, CAE. "Our staff and members who create this content make these efforts shine—it truly does take a village and strong leadership."

The Society would like to recognize its member volunteers and industry partners whose collaboration has been integral to its success:

- Karla Haack, PhD, and Matthew Haack, MD (authors of winning I Spy Physiology Blog post)
- Brad Latham, Latham Creative LLC (design of *The Physiologist Magazine*)
- Melanie Padgett Powers, MelEdits (managing editor and writer, *The Physiologist Magazine*)

DIVERSITY, EQUITY AND INCLUSION

New Name Change Policy

APS has made it easier for researchers to change their names on work published in the Society's 16 journals with its new Author Name Changes after Publication policy. The new process is in line with the Society's overarching efforts to increase diversity, equity and inclusion within the physiology community.

APS authors can modify their names on previously published articles for a number of reasons, including but not limited to gender transition, relationship status (marriage/divorce) and religious practice. Upon request, APS will update and republish the paper and provide the updated metadata to indexing services.

For more information and to request name changes after publication, email **apsproduction@physiology.org**.

AWARDS

A. Clifford Barger Underrepresented Minority Mentorship Award (Deadline: September 15)

Bodil Schmidt-Nielsen Distinguished Mentor and Scientist Award (Deadline: September 15)

Henry Pickering Bowditch Award Lecture (Deadline: October 1)

Physiology in Perspective: The Walter B. Cannon Award Lecture (Deadline: October 1)

Visual Career Abstract Award (Deadline: November 1)

Annual Marion J. Siegman Lectureship Award (Deadline: November 14)

Local Undergraduate Research Awards in Physiology (Applications accepted on an ongoing, year-round basis)

More details: www.physiology.org/awards

CALLS FOR PAPERS

American Journal of Physiology-Cell Physiology (September 30, 2021)

- Epigenetic Regulation of Cell Signaling
- Making Cell Culture More Physiological
- Virus-host Cell Interactions and the Viral Life Cycle: Basic Science to Therapeutics

American Journal of Physiology-Gastrointestinal and Liver Physiology (no expiration)

- Adaptations of Physiologic Systems to Promote Cancers
- The Chronification and Treatment of Visceral Pain
- Coronavirus Disease (COVID-19) and Digestive System
- Gastrointestinal Issues in Neurological Diseases
- Microbiome-based Therapeutics and Their Physiological Effects
- The Physiology of Cellular Organelles

American Journal of Physiology-Heart and Circulatory Physiology

- New Developments in Translational Microcirculatory Research (September 30, 2021)
- Getting It Right (no expiration)

Journal of Neurophysiology (JNP) (September 30, 2021)

- Society for the Neural Control of Movement
- Spinal Networks and Spinal Cord Injury: A Tribute to Reggie Edgerton
- Vestibular and Oculomotor Function in Health and Disease: A Tribute to W. Michael King, PhD
- Visual, Vestibular and Somatosensory Interactions for Visuomotor Responses: A Tribute to Jerry Simpson
- The Neurophysiology of Consciousness

More details: www.journals.physiology.org/calls

MEETINGS & EVENTS

CONFERENCES

Seventeenth International Conference on Endothelin (ET-17) Virtual conference dates: October 4–7, 2021

- Registration deadline: October 7

More details: www.physiology.org/ETconference

New Trends in Sex and Gender Medicine Virtual conference dates: October 19–22, 2021

- Registration deadline: October 19

More details: www.physiology.org/SexGenderConf21

WEBINARS

INFLAMMATION AND IMMUNOPHYSIOLOGY SERIES

Cardiovascular Diseases Associated with HIV and SARS-CoV-2 Infections September 9, 2021

Premature Vascular Disease in Autoimmunity October 7, 2021

Immunophysiological Mechanisms that Limit Dissemination of Microbial Signals from the Intestine November 11, 2021

SCIENCE OF AGING SERIES

From "Artificial" to "Real": What 24/7 Home Cage Monitoring Teaches Us in Pre-clinical Neurodegenerative Disease Models September 15, 2021

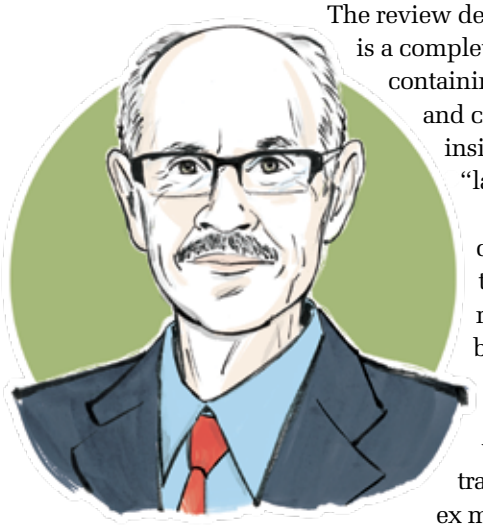
Aging and Skeletal Muscle Plasticity September 29, 2021

Cardiac Inflammation and Repair Following Myocardial Infarction October 13, 2021

More details: www.physiology.org/webinars

Celebrating 100 Years of *Physiological Reviews*

BY SADIS MATALON, PHD, FAPS



The great Greek philosopher Aristotle wrote in his *Poetics* that a "tragedy, then, is a process of imitating an action which has serious implications, is complete, and possesses magnitude; by means of language which has been made sensuously attractive ..."

When I was growing up in Athens, Greece, and often attending (against my will, of course) performances of "Antigone," "Oedipus Rex" and many others, never did I ever imagine that I would be at the helm of a scientific journal—as editor-in-chief of *Physiological Reviews*—that produces such great works with profound impact on all branches of science. I would like to think that I have spent my entire life preparing for this great honor.

One hundred years ago, Drs. J.A. E. Eyster and Walter J. Meek published "The Origin and Conduction of the Heart Beat," the first review article published in *Physiological Reviews*. The article was an authoritative treatise of the physiology of the heartbeat, clearly an important topic of great interest even today.

"A century later, *Physiological Reviews* is the most respected and cited physiological journal in the world."

A century later, *Physiological Reviews* is the most respected and cited physiological journal in the world. We publish highly authoritative, non-biased and informative reviews that are highly cited by basic, translational and clinical scientists engaged in biomedical research and patient care. It is a mark of excellence for an author to be asked to contribute an article. Authors labor for years to complete the final versions.

Many of us started our scientific careers after reading the works of masters in *Physiological Reviews*. Indeed, more than 36 articles have been written by Nobel Prize winners. To this extent, each review published in the journal resembles a Greek tragedy, like those written by Euripides, Sophocles and Aeschylus many centuries ago. The review deals with an important topic, is a complete treaty on the subject containing hundreds of references, and contains carefully chosen, insightful words to ensure the "language to be attractive." The careful and constructive comments of the reviewers and editors resolve problems and help bring along each review to a happy ending. Here again we have another analogy with the Greek and Latin tragedies in which the "Deus ex machina," or "god out of the machine," seems to resolve very difficult situations. The final products, further enhanced by the talented graphic artists and copy editors, are critical and authoritative interpretations of significant areas of physiology and medicine, presented in a clear, pleasing and compelling way.

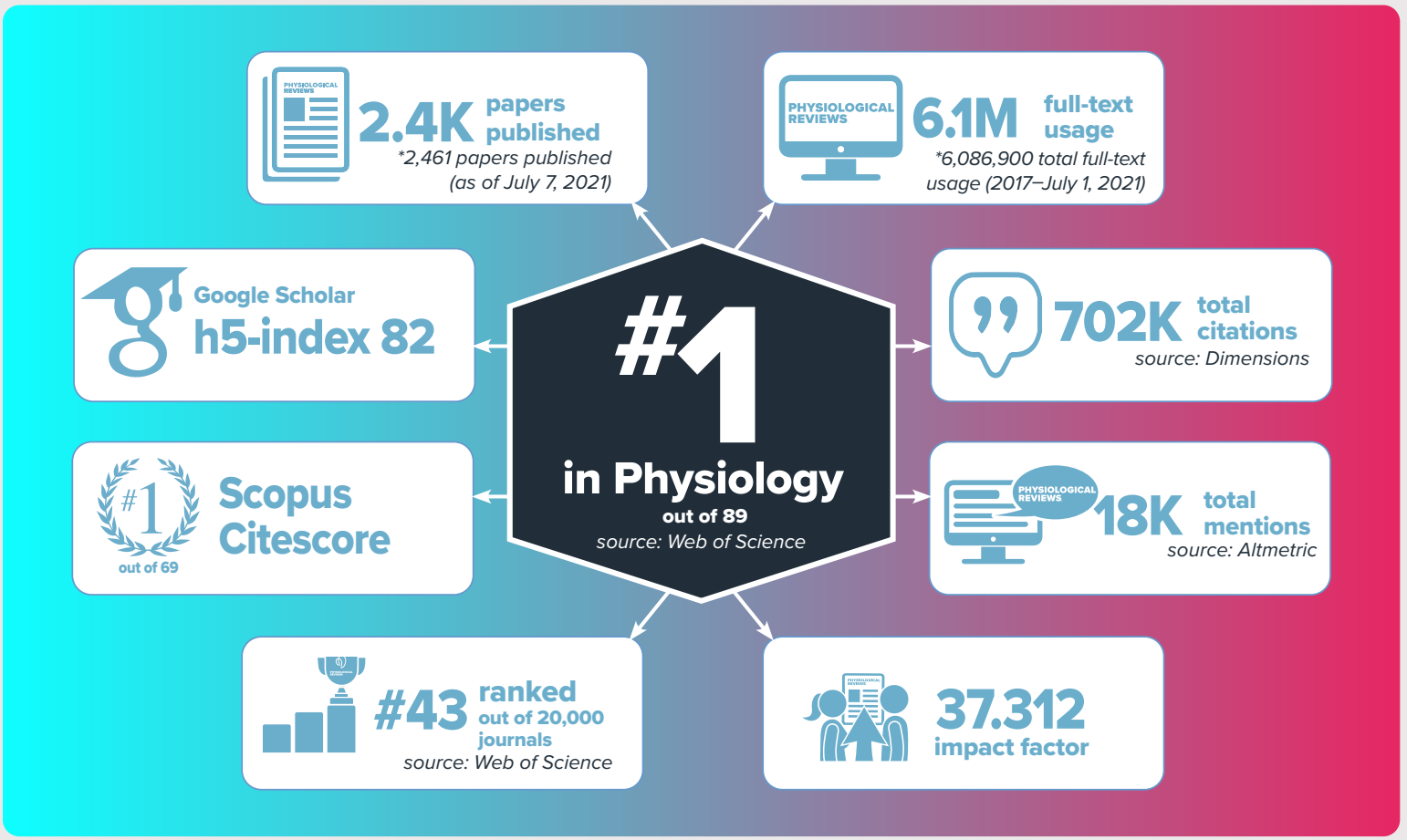
My most prized achievement as editor, without doubt, is the establishment of an early-career editorial board. Learning how to constructively review these in-depth articles is a challenging and time-consuming task requiring mentoring by senior editors. It is our duty—and time well spent—to ensure that we pass the baton to the most promising young scientists, who will carry on the tradition of excellence and service to the scientific community.

As I think about the centennial celebration for *Physiological Reviews*, I'm confident that the next hundred years look even brighter than the first hundred. I predict that the journal will continue in its storied tradition and remain an influential standard bearer for the discipline.

Sadis Matalon, PhD, FAPS, is Distinguished Professor and Alice McNeal Endowed Chair of Anesthesiology and director of the Division of Molecular and Translational Biomedicine at the University of Alabama at Birmingham. He is also editor-in-chief of *Physiological Reviews*.

Illustration by Brett Affrunti

Seminal Works. Lasting Impact.



The American Physiological Society journal *Physiological Reviews* is turning 100! Celebrate this monumental step by checking out the most cited *Physiological Reviews* articles of all time.

View now at **tinyurl.com/PRV100th**.

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